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GENERAL NOTES

The Henry Draper Catalogue

The recent publication by the Harvard College Observatory of the first volume of the Henry Draper Catalogue marks the close of half a century in a new branch of astronomical research, that of stellar spectroscopy. In this field of investigation the name of Dr. Henry Draper will always be honored as one of a group of brilliant pioneers whose skillful researches laid the foundations of the present science. To him we owe the first successful photograph of the spectrum of a star on which the characteristic lines were visible. His work, cut short while in the prime of life, by his death in 1882, fortunately passed to the hands of one who had already achieved marked success in the same field. Thru the generous provision of Mrs. Draper, the Henry Draper Memorial was founded at Harvard College Observatory, and to Director E. C. Pickering came the opportunity and the responsibility of developing and carrying thru to successful completion the task of securing the data for a great catalog of stellar spectra.

It was early recognized by Professor Pickering that the "slitless spectroscope" arranged in the manner first used by Fraunhofer in 1823 and later by Secchi, possessed distinct advantages for this class of work. By placing in front of a photographic objective a prism of small refracting angle and of approximately the same aperture as the lens, each star image is spread out into a narrow spectrum on a photographic plate placed at the focus. In order to obtain sufficient width of spectrum for the better representation of the spectral lines it is only necessary to give the driving clock a rate differing slightly from the sidereal rate. Evidently this method of procedure was well adapted to a qualitative study such as was to be made in a great Durchmusterung of stellar spectra, since the spectra of all of the stars of sufficient photographic brightness in the field would be recorded on the photographic plate. With instruments of this type a photographic survey of the whole sky has been made at Cambridge and the southern station in Arequipa, Peru.

A study of the spectra of several thousand stars obtained on these plates has been made by Mrs. Fleming, Miss Maury and Miss Cannon under the direction of Professor Pickering, at various times during the progress of the work, each independently adopting a system of classification which to her appeared to represent best the different spectral characteristics. It was apparent from the beginning of their studies that the four classes of stellar spectra proposed by Secchi were utterly inadequate for describing the finer details revealed on the photographic plate. The system adopted by Mrs. Fleming in her early work, that of arranging the spectra in groups, to which were given the letters of the alphabet from A to P, was later modified by Miss Cannon, by dropping some of the letters, changing the order of others and introducing the representation of spectra intermediate between two classes by the division of the class interval into ten divisions symbolized by the ordinals from 1 to 10. On this system the main groups of stellar spectra are in the order of sequence O, B, A, F, G, K, M, R, N, while the gaseous nebulae are grouped under class P, which precedes class O. It is the classification which has been unanimously adopted by the International Committee appointed by the Solar Union and is in universal use today.

In 1890 appeared the first catalog giving the results of the classification of the spectra of over 10,000 stars by Mrs. Fleming and known as the Draper Catalogue. Succeeding volumes contain revisions and extensions of this work by Miss Maury and Miss Cannon, so that we have at present fairly complete data concerning the spectra of the stars down to the sixth magnitude and in many cases for somewhat fainter stars. The plates of the Henry Draper Memorial from which the former data of spectral class were obtained show also the spectra of much fainter stars, and it was with the object of making available this wealth of information that the Henry Draper Catalogue originated. On these plates, several thousand in number, the total number of spectra classified is 242,093 relating to about 222,000 stars. This enormous task was performed by Miss Annie J. Cannon, with the aid of an average of five assistants, in the incredibly short time of four years. The preparation of this material for publication is equally laborious and will require an additional four years.

The present volume, which appeared in December, 1917, is the first of nine large volumes which will be required for the entire catalog. It contains in addition to the catalog designations and positions of the star for 1900, the photometric and photographic magnitudes and spectral class of 25,763 stars included within the first four hours of right ascension.

That numerous changes have been made in the class of spectrum formerly assigned to many of the brighter stars is indicated by a comparison of the first volume of this catalog with previous determinations by the Harvard observers, but in general such changes do not amount to more than a half interval between classes. A cursory examination of the present volume gives the impression that a preponderance of these changes has been toward increasing the number of stars in the middle types.

Due to the different conditions under which the plates were taken, transparency of the air, seasonal conditions, different instruments, etc., it is evident that fainter stars will be recorded on some plates than on others. Hence for some portions of the sky the catalog embraces tenth and even eleventh magnitude stars, while for others the limiting magnitude will be brighter. No statement is given in the present volume of the limiting magnitude for which the catalog is complete. Undoubtedly such information will be furnished in a future volume, as the proper use of the data for statistical purposes requires a knowledge of this factor.

That the spectroscopic material of this great catalog will be of inestimable value in furthering our knowledge of the stellar system may be seen from a brief enumeration of some of the lines of investigation dependent upon it. Undoubtedly its most important application will be to statistical studies of stellar distribution with reference to spectral type. It will permit of further studies of the correlation between spectral characteristics and certain other stellar properties, such as parallax, proper motion, radial velocity, etc. By its means, also, the important relations which have been found between spectral type and the period and eccentricity of binary orbits may be extended to fainter objects.

The Henry Draper Catalogue is the product of a carefully laid plan, skilfully developed and carried thru with unfailing enthusiasm. To the genius of Professor Pickering, in planning and directing this great work, and to his brilliant associate, Miss Cannon, thru whose untiring efforts it was accomplished, astronomical science is indebted for one of its most important contributions, a work which will prove a lasting tribute to the memory of Dr. and Mrs. Draper.

J. H. MOORE.

Nova Aquilae, No. 3.—From data given in the *Astronomische Nachrichten*, Nos. 4949 and 4950, recently received, it seems probable that W. J. Luyten, at Deventer, Holland, saw the Nova and suspected its character on the evening of June 6, 1918. He was engaged in making a drawing of the Milky Way and noted a star near *θ Serpentis*, which was not much fainter than 64 *Serpentis* (5.8 magnitude) and which he did not recognize. Apparently he did not look up the star that night, but on June 7 made a rough sketch of the region between 4 *Aquilae* and 64 *Serpentis*, and on June 8th, when he again saw the Nova (now of the first magnitude), found that its position agreed well with that of the unknown star on this sketch.

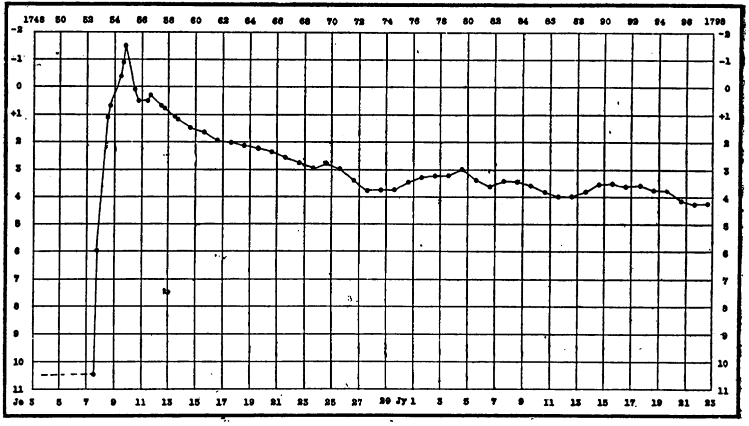

FIG. 2. PROVISIONAL LIGHT CURVE.

Other reliable early independent discoveries are those of an amateur, Herr T. Meesters, near Amsterdam, who saw the star at 8^h8^m G. M. T., June 8, and of M. M. Luizet, of the Lyons Observatory, whose observation was made at 8^h40^m G. M. T., June 8th. Mr. Innes states that it was seen by Mr. R. Watson, Beaufort-West, C. P., at 7^h53^m G. M. T., June 8, as a star of the second magnitude. According to *H. C. O. Circular* 208, the first American observer of the star was Mr. Vincent Francis, of New Bedford, Mass., who saw it at 13^h00^m G. M. T., June 8th.

It is a curious psychological fact that perfectly honest people have been able to convince themselves that they discovered the Nova at dates earlier than those just mentioned and at a time when the observation was physically impossible. The photographic record at Harvard makes it certain that the Nova was not visible to the unaided eye under ordinary conditions before June 8th; yet in *A. N.* 4949 are given observations by an amateur who saw it on June 6th, and again on June 7th, as a star *brighter than the first magnitude!*

I have letters from a gentleman in Oakland, California, stating that he saw the star as "a conspicuous object," and pointed it out to friends, in the early evening of June 7th, "the evening before the eclipse of the Sun." The Harvard photographs show that the star was then of the 6th magnitude and therefore *inconspicuous* under the most favorable atmospheric conditions even to the trained eye.

The accompanying diagram, taken from *H. C. O. Circular* 208, shows the preliminary light curve of the Nova, based upon 523 observations by 71 different observers. The fluctuations it exhibits are similar to those in the light curve of *Nova Persei*, No. 2.

R. G. A.

Telescope for Sale.—Mrs. E. Lang, 41 Langton Street, San Francisco, who is about to return to Paris, France, has a small telescope which she will be glad to dispose of. Mr. Lang was greatly interested in astronomy and secured this telescope for work as an amateur. The telescope tube is of brass, aperture 2½ inches, small finder attached. It has a right-angle prism ocular, four eye-pieces of different powers, a terrestrial eye-piece, and a dark glass eye-piece. It is mounted on a brass tripod. The whole is inclosed in a heavy wooden case.

The original cost, from "Secretan" Paris, was 500 francs. Mrs. Lang offers the telescope for $30.00. Those interested should communicate with her at the address given above.

CORRECTIONS

By inadvertence, the orientation was omitted for Mr. Ellerman's photographs of the Corona and Prominences made at Green River, which are reproduced in the half-tone facing page 250 in the August number of these PUBLICATIONS. North is at the right-hand margin of each figure, west at the top.

On page 263, third line from bottom, *for* 1.4 magnitudes read ¼ magnitude.